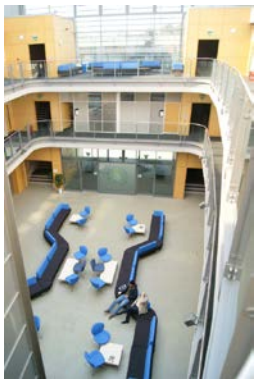
The University of Nottingham

UNITED KINGDOM · CHINA · MALAYSIA

POST OCCUPANCY EVALUATION REPORT

ENGINEERING AND SCIENCE LEARNING CENTRE



QTC projects

JULY 2013

FINAL

1. Introduction

QTC Projects were appointed to carry out the Post Occupancy Evaluation following the submission of a tender for services dated 23 November 2012 to the Development Director, University Estate Office.

2. Scope of the Review

Evaluation Technique

The evaluation was conducted at Project Review stage (1 – 2 years after handover) and has been undertaken in line with the criteria and guidance contained in the HEFCE/AUDE publication, 'Guide to Post Occupancy Evaluation'.

Analysis

Analysis broadly followed the University's brief for undertaking the evaluation and consisted of reviewing all written information received concerning the building together with information collated from the questionnaires and workshop. Particular areas reviewed were:

Purpose and scope of project (brief)
Some aspects of the building procurement process
Building user feedback
Cost management and control
Construction and project management
Functional and technical performance
Sustainability - Assessment against BREEAM criteria
- Review of energy efficiency measures incorporated into the design
- Reference to the University's Carbon Management Plan

Questionnaires

Questionnaires were developed to obtain information and feedback from four specific groups:

a) User (On-line survey)
- a representative sample of 148 users of the building being evaluated consisting of Admin/Research staff and UG/PG students

b) Consultant Design Team
- Architect
- Project Manager
- Quantity Surveyor
- Services Consultant
- Structural Engineer

c) Estate Office

d) Main Contractor

A Sample of the User Questionnaire is shown in Appendix 1.

Interviews

Interviews were held with the following:

a) Graduate Centre
   - Tessa Payne, Head of Graduate School

b) Engineering & Science Support Centre
   - Charlie Hallam, Faculty Infrastructure Manager
   - Delia Stirland, Student Support Manager

c) Conferences Division
   - Gayle Timmins, Event Manager

d) Prof Wyn Morgan, Assistant Pro Vice Chancellor and Director of Teaching and Learning

b) Estate Office
   - Tim Brooksbank, Development Director
   - Richard Wigginton, Senior Capital Projects Officer
   - Barry Chadwick, Operations and Facilities Director

c) Hopkins Architects – Steve Jones

d) GTMS Project Manager – Miles Delap (telephone interview)

h) Gardiner and Theobald – Alastair Wolstenholme (telephone interview)

f) Arup M&E/Structural Engineers – Steve Fernandez

e) Mansell Construction – Rob Sullivan (telephone interview)

Workshop

A half day workshop was held on 10 July 2013 (a list of attendees is shown in Appendix 2).

The format for the workshop was a presentation by QTC Projects acting as facilitator which included feedback from the user satisfaction questionnaires. The workshop helped to highlight the key issues that had been raised in the questionnaires and interviews which were then discussed and debated.

The information from the workshop provided important comment which has been incorporated into this report.

3. Building Data

Name	Engineering and Science Learning Centre
Size	3551m² (Gross Area)
No of Storeys	3 storeys
Occupants	Engineering and Science Support Centre Graduate Centre Learning and Teaching space
Types of space	Offices (cellular and open plan) Meeting/seminar rooms Centrally Timetabled seminar rooms Computer Suite Informal study/social space Multipurpose Foyer/Atrium space Seating space for adjacent catering area
Construction Period	14 weeks enabling works contract 68 weeks main construction contract
Start on site	1 June 2010
Contract Completion	21 June 2011
Practical Completion	18 July 2011

Construction Costs

At Start of Construction	Enabling works	£ 459,326
	Main contract	£6,002,052
	Total	£6,461,378
At Final Account stage	Enabling works	£ 316,418
	Main contract	£6,117,373
		£6,433,791
	Additional works	£ 948,930
	VAT	£1,476,544
	Total	£8,859,265
	Cost/m^2	£2,475 (excluding fees and any Direct Works)

Consultant Team

Project Manager	GTMS, London
Architects	Hopkins Architects, London
Cost Managers/QS	Gardiner & Theobald, London
Services Engineer	Arup, London & Nottingham
Structural Engineer	Arup, London & Nottingham
Contractor	Mansell Construction, Nottingham
Building Contract	JCT Design & Build 2005

4. Building Construction Details

Structural Frame – Reinforced concrete

Cladding – Aluminium rainscreen cladding

Windows – powder coated aluminium

Roof – Double skin ETFE to central atrium, single ply membrane to other roof areas

Mechanical Engineering Services

Closed loop ground source heat pump as primary heat source

District heating via connection to the University's HPHW system to provide an additional heating source

Perimeter heating via fan coil units

Underfloor heating to the atrium area with reverse cycle for cooling

Mechanical ventilation via AHU's providing heating and cooling

Night purging of building via automatic opening windows

Electrical Engineering Services

Energy efficient lighting with daylight and movement sensors

Small power with RCD protection

Split metered floor distribution boards

Building Management System

5. Project Background and Description

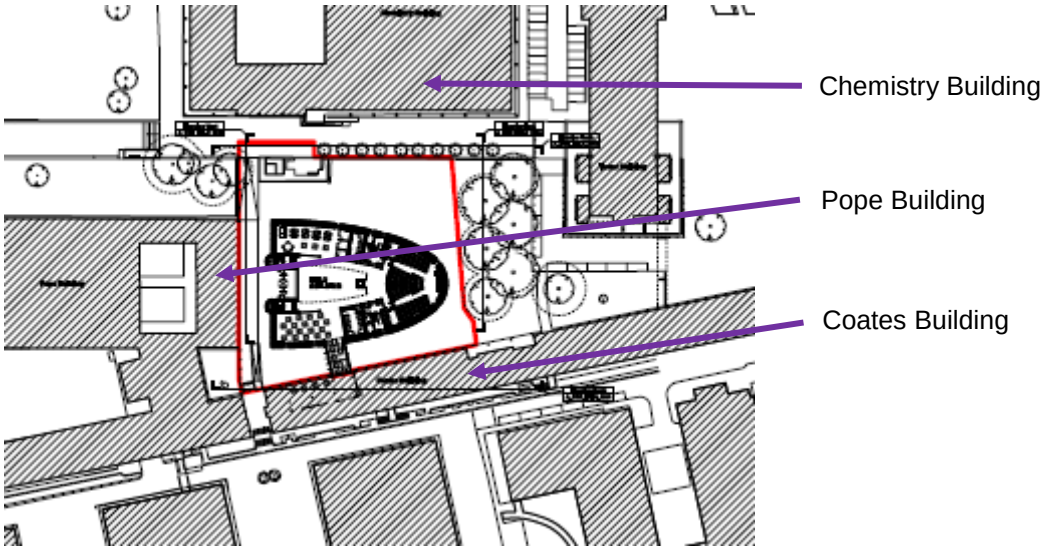
The brief for the new building clearly sets out the University's need for a central resource for the Faculties of Engineering and Science together with a range of seminar/teaching rooms which were to be centrally timetabled. Thus the building provides much needed study, teaching and social spaces.

Important factors and objectives for the building:

- Carefully consider the presence and overall impact within the campus environment
- Need to exploit sunlight and best views into and out of the site
- Building should reflect its function whilst maintaining an overall cohesive design strategy
- Allowance in the design for flexibility of internal planning
- Ground floor connection to the Coates Building in order to access the catering facilities

The brief was later extended to include refurbishment of the Coates building café and external landscaping. Also, in order to create a staff presence in the building, the undergraduate centre was changed to offices and reception to support engineering and science students.

A restricted site presented a challenge to the design team. This site had been identified in the Hopkins Architects Initial Briefing Document and is fairly central, surrounded by the Chemistry, Coates and Pope Buildings. It is also on a main pedestrian route through the campus



The heart of the building is the large atrium which provides a central multi-functional area used for a variety of activities. Varying capacity seminar rooms are arranged off the atrium on all three floors with a dedicated Graduate Centre located on the third floor.

Overall the building provides a feeling of space when first entering enhanced by the natural light gained from the ETFE central roof area. The finishes and building components used are of a good quality which contribute to the building's presence on site.

Externally, the building presents an interesting shape and design solution. An external curved screen of extruded aluminium horizontal tubes wraps itself on three sides around a basic rainscreen clad concrete framed structure punctuated with horizontal bands of glazing. The flat gable end facing the Pope Building is clad in horizontal aluminium louvres balanced by two vertical drum staircase elements also rainscreen clad.

The roof materials comprise a central double skinned ETFE roof with perimeter sloping areas finished in a single ply membrane.

The overall construction works were undertaken first as an enabling works contract followed by the main contract works. This was done to avoid the exam period whilst maintaining a completion date which would have the building ready for occupation at the start of the new academic year in September 2011.

The building achieved a BREEAM excellent rating and was completed within budget taking into account the additional works.

A full list of project milestones is shown in Table 1.

Table 1 Project Milestones

Project Execution Plan issued	March 2009
Design Brief	March 2009
Stage C report	31 July 2009
Main contract tenders invited	12 Jan 2010
Enabling works commence	25 Feb 2010
Main contract tenders returned	5 March 2010
Tender report	April 2010
Enabling works completed	May 2010
Main contract start on site	1 June 2010
Practical completion	18 July 2011
Completion of catering works	Sep 2011
Final account agreed	May 2012

6. User Satisfaction

Building user satisfaction has been assessed from the responses to the questionnaires received and analysis of the comments made. The results are shown in a series of bar charts covering the following areas:

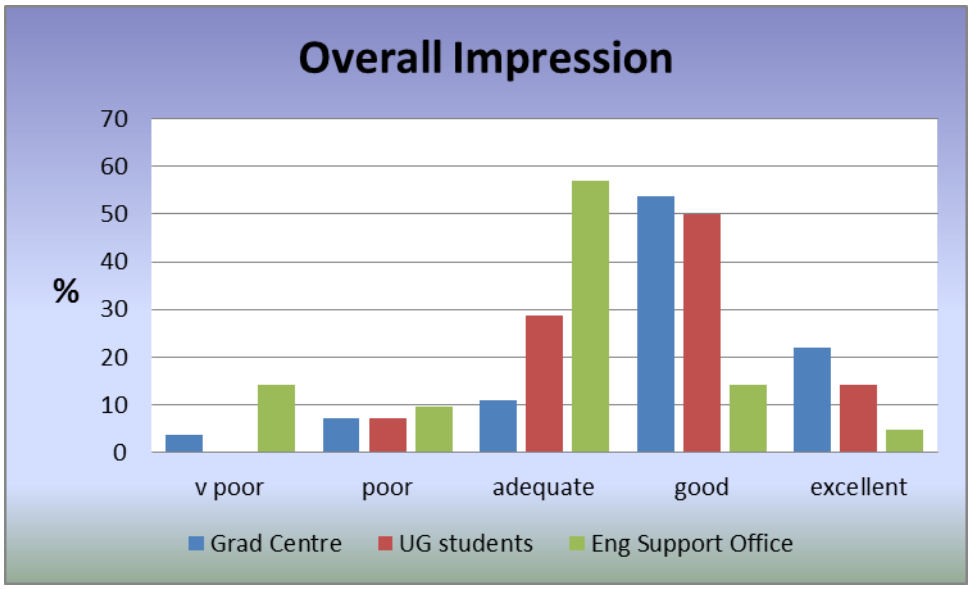
- Satisfaction with specific room types, ie shared office, Graduate Centre spaces, meeting rooms, central timetabled rooms, toilets, kitchen, café area, storage and overall impression of the building
- Security
- Accessibility
- Cleanliness
- Internal room temperature
- Distraction from noise
- Lighting conditions, natural and artificial
- Data connectivity at the workspace
- AV equipment in teaching/lecture rooms

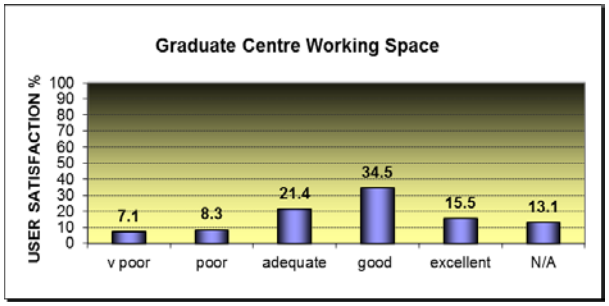
Overall, 148 responses were received from a representative group comprising:

Admin staff from the Engineering and Science support office (21)
PG students from the Graduate Centre (113)
UG students using the central timetabled rooms and other facilities (14)

Users were asked to give a response on their overall impression of the building and, with the exception of the Student Support Office, has shown a high level of satisfaction with the following ratings for percentages in the good/excellent range;

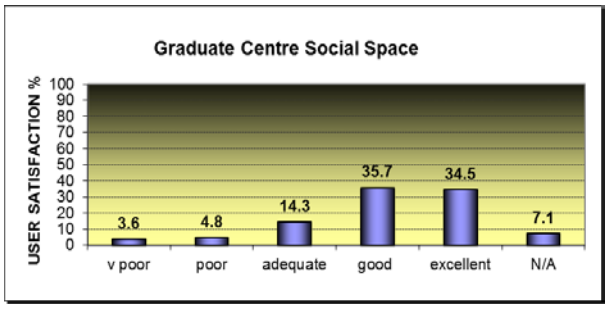
Graduate Centre	75%
UG Students	64%
Engineering Support Office	19%

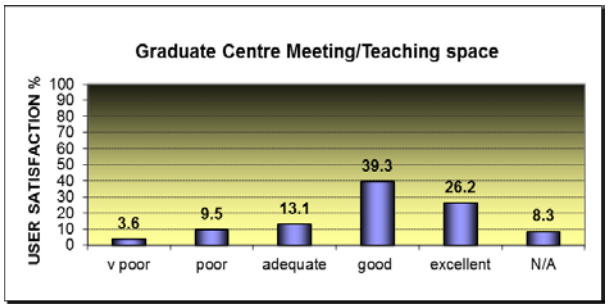




The Graduate Centre provides excellent facilities for PG students and “a very positive experience”

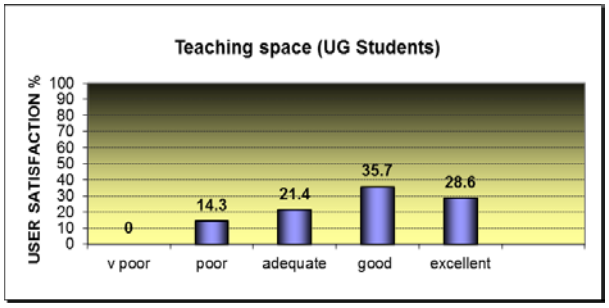
Areas for social gathering, group working, quiet study and formal seminar space all contribute to this overall facility. The working and social space are rated fairly high with 57% of respondents rating them good/excellent.

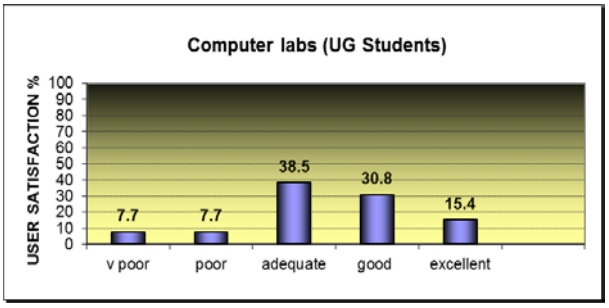




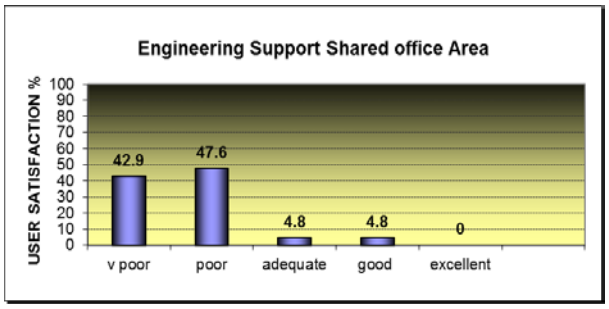
The teaching space is reasonably flexible and can be used for different styles including studio working although the shape of the room is said to limit some layouts. Nevertheless 65% of respondents rated this room good/excellent.

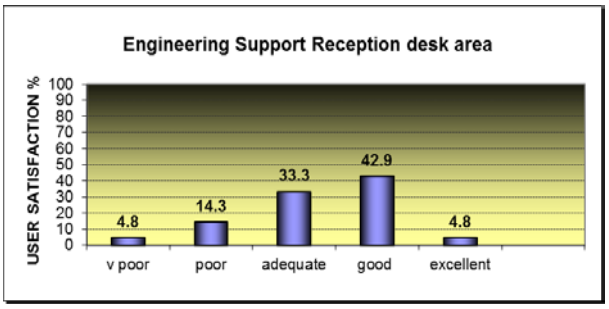
There is a range of teaching/seminar rooms of varying capacities across all floors of the building. These provide additional teaching space within the central timetabled pool. Of the responses received, 65% rated them good to excellent despite some comments made about room C01.





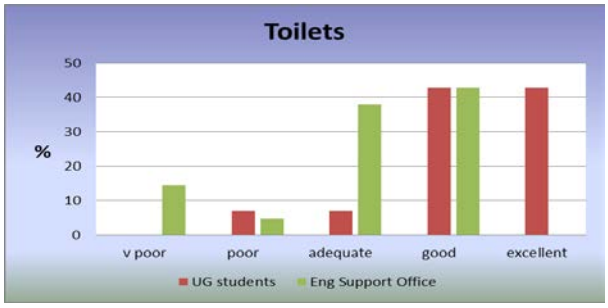
The computer suite has the highest utilisation rate of all the central timetabled rooms reflected in the responses made.



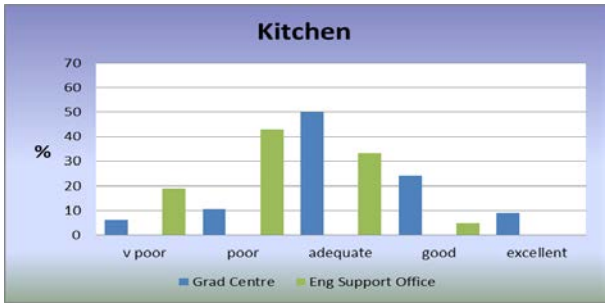


The area of least satisfaction is the office space used by the Engineering Student Support staff. Their main criticism is the layout of the office and poor comfort conditions. Over 90% of respondents rated this space as poor or very poor. Lack of storage is also considered to be a problem.

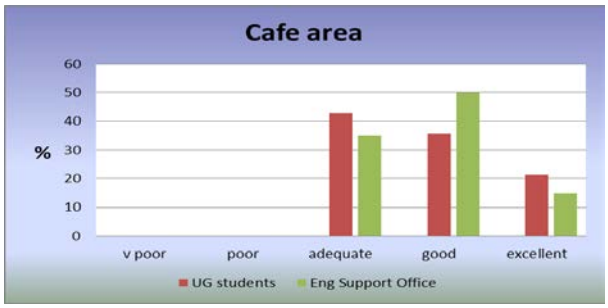
The responses to the reception desk area are more positive. This area has improved following alterations to the layout and desk design.



UG students and Engineering Support Office staff were asked to comment on the toilets. Generally a reasonable response was received with 85% of student responses rating them good/excellent and 81% of staff rating them adequate/good.

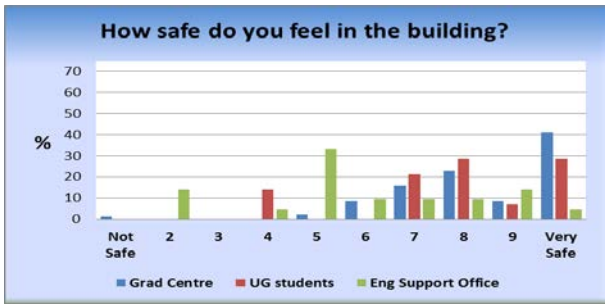


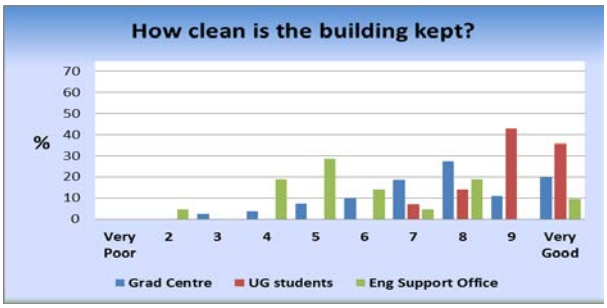
The Graduate Centre and Engineering Support Office have their own small kitchens. Some comments concerning the size of the facilities were made by both groups of respondents.



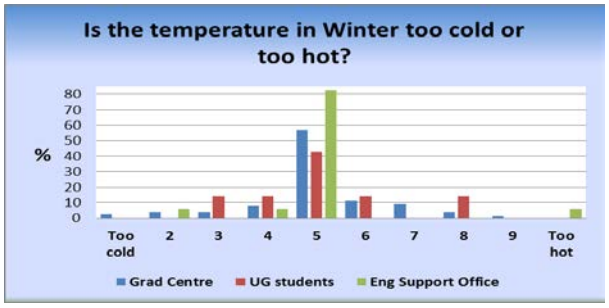
The café area in Coates Building was rated very highly with the direct link between ESLC and Coates Building helping to improve access. Additional seating has improved this area together with the overall refurbishment of this space.

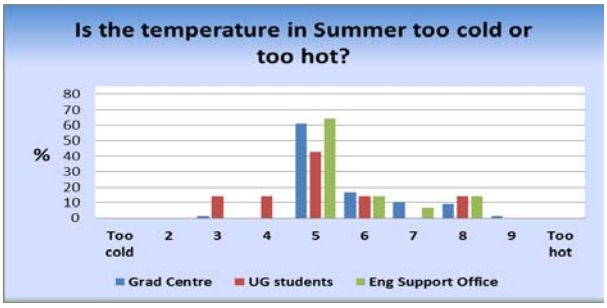
Looking at the charts for building amenity and comfort, most users felt safe in the building and there were no major criticisms. Cleanliness was considered to be generally good but with some negative comments from Engineering Support Office staff regarding the cleanliness of toilets following peak time use.



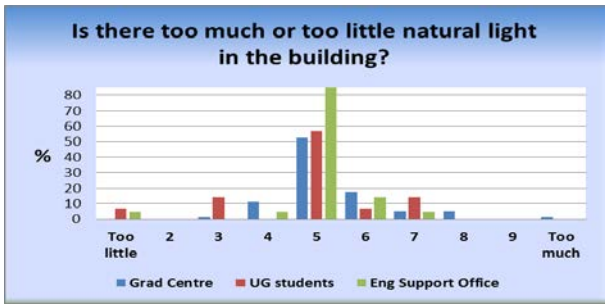


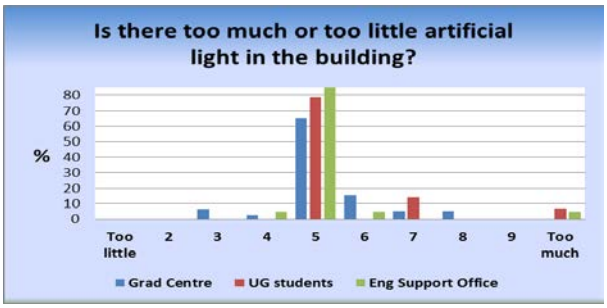
On the question of room temperature, in most cases this was acceptable but in Summer respondents' comments suggest that a small number of rooms in the building were too warm. However it has been confirmed that these temperatures are within the parameters set out in the CIBSE Design Guide.

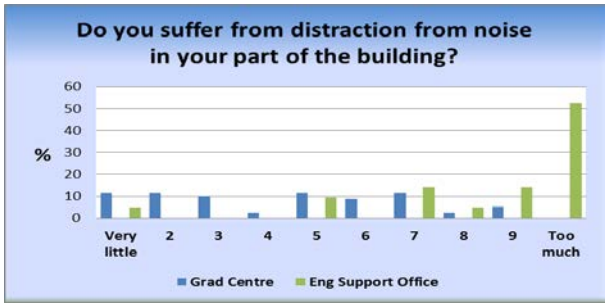




Regarding natural and artificial light there is a view that natural and artificial lighting was about right. On average 66% of respondents gave natural lighting a rating of 5 (neither too much nor too little) with a corresponding 76% rating artificial light similarly.

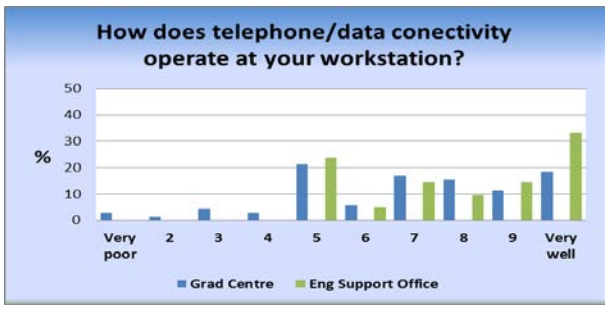


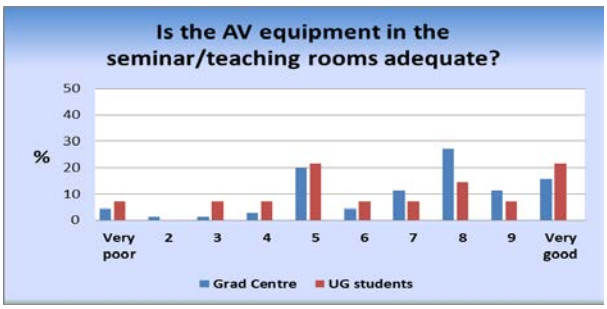




With the Graduate Centre having its own dedicated space for PG students, negative comments on distraction from noise are fairly minimal. This is not the case with the Support Office space. The cramped working conditions are contributing to this together with the fact there is no barrier between the office working area and student activities at the reception desk.

Regarding IT connectivity at the workspace in the Graduate Centre and Student Support Office, this is regarded as fairly good with no major criticisms except for poor Wi Fi reception at times. Student comments regarding AV facilities in seminar rooms is across the full range with some students not liking the large seminar room C01.





Resulting from the questionnaire responses, interviews and various discussions, a number of issues have been highlighted and were presented at the POE workshop for further discussion/debate. The issues have been grouped under the following headings and considered in more detail in this report.

- User Issues
- Design Issues
- Construction Issues
- Facilities and Operations
- Project Management
- Procurement and Cost Management
- Sustainability

7. User Issues

A number of user issues were raised during the interviews and from the questionnaire returns which were discussed at the workshop. These are listed below and commentary given.

7.1 Engineering Student Support Centre

Office Space

The shared office space occupied by the Engineering Support Centre staff was originally designed as part of the Undergraduate Centre. Located to the side of the atrium, this was intended as an open walk-in space for student use for learning activities.

A late instruction by the client (requested by the Dean and endorsed by PMG) after six months construction on site changed this space into an open plan office area for administrative staff with a reception counter to deal with student matters.

As shown earlier, the user satisfaction for this area is very low primarily due to the number of staff accommodated in the working area provided (21 staff originally, now increased to 24 by the Faculty of Engineering). A calculation of the floor area (excluding the reception counter area) shows that at 21 staff, this equates to 4.1m^2 per person which is around the minimum level of the University's space guidelines.

View of shared office space

View of reception desk area

The layout of the reception counter has improved since its re-design but the main issue for the occupants is the working conditions.

The layout of this area is not as originally intended and every effort has been made to accommodate its revised use within the constraints of the building. Where late changes of this nature occur on projects in future, PMG should be made fully aware of the implications.

Noise Disturbance

The nature of open plan working is that there will be noise from other office users in general conversation, telephone calls and moving around the office. The additional disturbance in this case is from student activity at the reception desk (600-800 students passing through at peak times) and from activities taking place in the atrium.

The latter problem has been improved through the installation of automatic glass doors to the Support Centre. Further changes were also made to improve noise insulation by changing the controls to the automatic doors as these were opening on a regular basis.

It was suggested at the workshop that some form of screen might help between the office area and rear of the reception counter.

Temperature

Comments from user representatives during interviews and from the satisfaction survey show that temperature and air quality can be a problem in this area and the fire door has been wedged open to improve ventilation.

As this space was originally open to the atrium, the building services design allowed for ventilation of the atrium via this office space which resulted in unacceptable temperatures being experienced when the space was converted. The automatic windows were therefore closed down which did not prove to be a satisfactory solution.

This should have been monitored by the Maintenance Team and adjustments made where necessary. It is understood the automatic windows have now been re-activated and controlled locally during normal working hours.

Storage

Users have complained of inadequate storage areas. The Faculty has to store a large amount of course work which has to be processed three times and needs to be stored securely. Although around 25% of the Faculty's course work has changed to electronic format, the problem of lack of storage still persists.
This is a local management issue and the Faculty should consider more efficient ways of managing storage and improving shelving space in existing storage areas.

7.2 Graduate Centre

Despite some negative comments made by PG students, the Centre remains an excellent venue which is well used. It provides a positive experience for users and the Graduate Centre Manager is very satisfied with the facility.

Graduate Centre Social/Study space

Graduate Centre Seminar Room

7.3 Conference Office

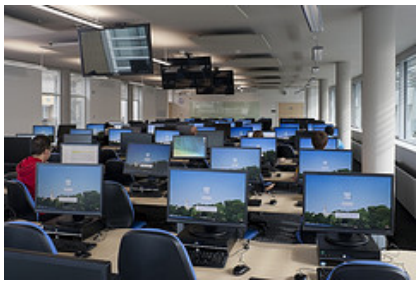
Comments from the Conference Office who use the facilities were also very positive. The combination of the use of seminar room A09, the atrium space and the adjacent café area make this a very attractive conference venue. There is good feedback from delegates and stackable chairs with folding tables makes setting up alternative layouts much easier.

7.4 Teaching Rooms

There are twelve seminar rooms in the building which are on the central timetable system together with the atrium area which is also bookable. The seminar rooms range in area from 20m^2 (meeting rooms B15/16) to 216m^2 (room C01). There is also the seminar room (C09) in the Graduate Centre but this is not a timetabled room.

Seminar Room C01

Seminar Room B12


Computer suite C13

A large capacity seminar room such as C01 is a much needed facility of this size. However comments have been made concerning the proportion of this room which makes it appear to have a low ceiling and requires repeater screens due to its length.

The disadvantages of this room shape for formal seminar use was raised at design stage but PMG agreed to retain this space on the basis that it would also be used for informal layouts and studio type working. It is understood that plans have now been drawn up to subdivide this space.

The Director of Teaching and Learning acknowledges that there needs to be more academic involvement in the development of these spaces at design stage. As a result, the University has established a Learning Spaces Working Group with Estate Office representation which reports to Space Management Committee and the Teaching and Learning Board.

Table 2 Timetabled Rooms

Room	Usage	Occupancy	Utilisation
A09	66.67	64.54	43.03
B01	63.89	43.79	27.98
B02	63.89	50.34	32.16
B07	58.33	41.44	24.17
B08	52.78	55.05	29.05
B12	80.56	69.78	56.21
B13	75.00	65.14	48.86
B14	52.78	37.16	19.61
B15	61.11	54.55	33.33
B16	52.78	53.95	28.47
C01	66.67	71.88	47.92
C13 (Computer Suite)	94.44	77.31	73.02
Overall	**60.68**	**52.69**	**35.68**

Taken from Estate Office Data (room survey carried out w/c 22 October 2012). Figures shown are for actual use

Analysis of the utilisation rates for the seminar rooms shown in Table 2 which took place in October 2012 shows that there is room for improvement. The overall utilisation rate of 35.7% is below what the University would expect and some rooms are below 25%. The building has been designed with flexibility in mind and it is therefore possible to subdivide some of the rooms to improve utilisation rates.

Generally equipment in the rooms is to a good standard but comments have been made on the glass 'white boards' used throughout the seminar rooms. These reflect light thus reducing visibility. It is understood this was the first building to specify this type of 'white board'. This has not been wholly successful and perhaps the appropriate board to address potential glare should be specified on future projects.

Recommendations

i) Where late client changes are made, PMG, having been provided with sufficient information, should be made fully aware of the implications of their decision

ii) In the Engineering Support Centre office consider installing a screen to reduce noise disturbance emanating from the student reception counter area

iii) Investigate the cause of the shut down of the automatic windows in the Engineering Support Centre office and reinstate/modify the automatic controls in order to improve air quality and temperature

iv) Complete the modifications to seminar room C01

v) Consider subdividing one of the seminar rooms with low utilisation rates in order to improve use

vi) Consider the specification of the 'white boards' on future projects appropriate for location and type of use

8. Design Issues

A number of comments relating to design were raised during the interviews and from the questionnaire returns which were discussed at the workshop. These are listed as follows and commentary given:

Design Brief and Reports

The University issued a design brief in March 2009 at the preliminary design stage. This was fairly detailed and provided sufficient information on which to prepare initial designs. A Stage C report was produced in August 2009. No stage D report was produced as it was felt that by this stage the Architects had produced details and working drawings over and above what would normally have been provided.

This ensured that a detailed information pack was issued to the contractors at tender stage.

Planning Stage

It was noted at the workshop that there were no issues with obtaining the necessary planning approvals. The site is fairly embedded within the campus and there were no particular constraints from a planning point of view.

Quality of Finishes

The building generally has elements and finishes of a high quality. This can be seen in a number of finishes and detailing, including the external cladding, internal balustrading and junction details.

The University has adopted a painted finish to exposed internal concrete surfaces and is satisfied with the end result as it masks any minor blemishes and discolouration and provides value for money.

The only area where it was felt improvement could have been made is the quality of the cast finish to the ring beam below the construction joint.

ETFE Roof

The central roof covering to the atrium is formed from a double skinned inflatable structure of ETFE material. It provides a cost effective lightweight structure and allows a high level of natural light into this central area.

Some comments have been made that noise is generated from this roof in heavy rain. This has only recently been raised by the Engineering Office and the Conference Office, who are the main users of this space, has not raised this as an issue. However the manufacturers offer an option of a mesh covering which reduces the noise level. This may be something to consider if the noise becomes unacceptable and budgets allow.

At the workshop there were comments from the maintenance team regarding the structural integrity of the roof should it deflate for any reason. It was confirmed that a standby generator has been provided and the systems/pumps are monitored through the Building Management System.

9. Construction Issues

Programme and Site Logistics

To meet the programme dates and avoid exam periods a separate ground works contract was implemented. This ensured that the main contract had sufficient time to complete the works before the start of the new academic term in 2011.

Occupancy of the timetabled rooms and Graduate Centre was achieved in accordance with the programme with all teaching rooms available as required. However the Faculty Student Centre experienced some commissioning and snagging problems due to the late change in the brief and occupancy requirements.

The refurbishment of the Coates Building café and external works which were added to the scope of the contract ran to a secondary, later programme but nevertheless were completed as scheduled.

The programme for the main contract works of 68 weeks was considered to be a reasonable period for the type and complexity of building constructed. Site logistics had to be handled carefully due to the site being fairly central, surrounded by existing operational buildings and on a main pedestrian route. Noise was a potential issue which had to be handled sensitively. With good communication with the Estate Office, overall the contractor performed well in this respect.

Design Responsibility

Design responsibility was defined clearly enough but some issues arose with the enabling works contractor when it was later found that the wrong type of rainwater harvesting tank had been ordered. There were also some quality issues with the enabling works which had to be resolved later with the main contractor.

As there was no novation on this contract and the design architects were retained on the client side, the contractor brought in a separate design team. The client-side architects had a retained services commission to check drawings and details and monitor quality. There were some issues between the client's architect and contractor in what was considered acceptable detailing. In the end, quality had to be balanced with cost but overall the University received a well detailed building.

Commissioning

Discussion at the workshop concluded that the commissioning period raised a number of issues and that the period of time allowed could have been longer. There were some metering issues with some equipment not connected to the Building Management System and interface with the district heating.

It was also found that the rainwater harvesting system was using freshwater instead of grey water (solenoid problem). These problems have now been resolved.

Defects/Issues Post Completion

All outstanding defects have now been resolved except for the resin floor to the ground floor of the atrium which is showing minor cracking at two of the door thresholds. Discussions are now taking place with the contractor and the matter is being dealt with.

Health and Safety

There were no health and safety issues raised, the contractor conducting site operations in a satisfactory manner.

Recommendations

i) Ensure sufficient time is allowed where possible for the commissioning period

10. Facilities and Operations

Involvement of the Maintenance Team took place through attendance at meetings and site visits. The process of communication with Facilities and Operations has improved and continues to do so on subsequent projects.

Fault reporting still causes some frustration with building users and the Engineering Student Support Centre had some minor problems with plumbing which took some time to resolve.

There were no issues raised at the workshop relating to building finishes. Regarding M&E services, the issues that were raised related to commissioning and the length of time allowed for this process.

The comments regarding the cleanliness of the toilets at peak times was noted and the Cleaning Manager confirmed that this has been addressed with an additional mid-day clean now put in place.

The issue of the cleaning of the resin floor was raised which required larger specialist cleaning equipment for which adequate storage had not been allowed for in the building. It was noted that the choice of the resin floor finish had been endorsed by PMG during the construction phase. Once selected, further consultation with the Cleaning Manager might have been appropriate.

Recommendations

i) Continue to improve the communication with the Maintenance Team

ii) Reinforce the procedure for fault reporting by users through the Helpdesk and encourage the building user to adopt this approach

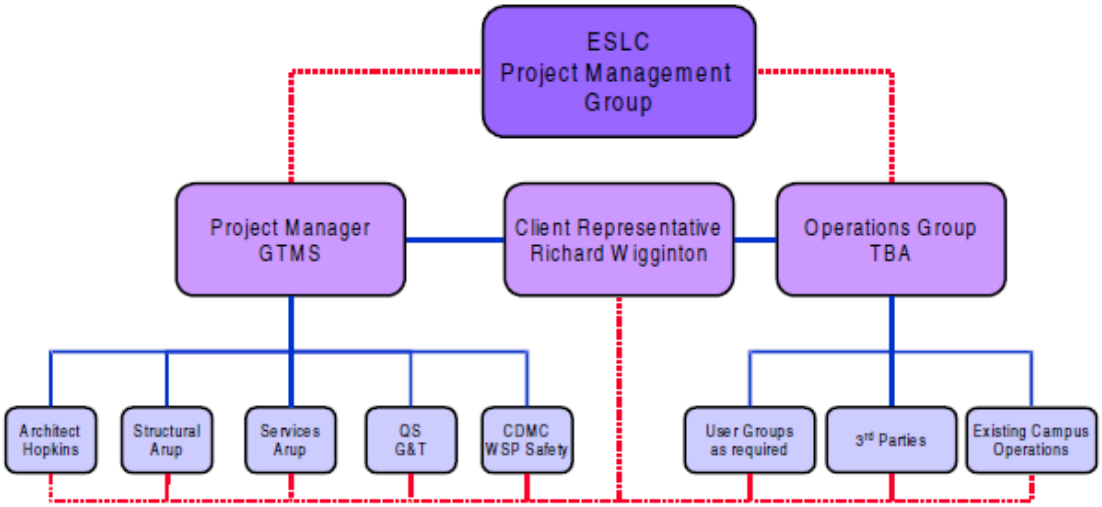
iii) Ensure FM Cleaning are consulted when finishes are selected/changed so that appropriate storage for cleaning equipment is allowed for

11. Project Management

As with all University major capital projects, this project was overseen and monitored by the Project Management Group (PMG) which had representation on the Group from the building user client (Deans of Science and Engineering).

The Consultant Project Manager produced a detailed Project Execution Plan which set out clearly the scope and broad objectives for the project, communication protocol and change control procedures.

As part of the communication process, the Consultant Project Manager set up an operations Group to act as an interface between the users and project team. It was to meet every month or when required during the construction phase.



It was felt that this arrangement did not work particularly well due primarily to the building being used for general teaching with limited user groups and third parties.

Communication between the Consultant Project Manager and the Estate Office worked well. Information from the Estate Office was considered clear and precise particularly the overall brief. The design guide provided a useful reference point for the Consultant Team.

Client changes on the project were not excessive apart from the changes to the Faculty Student Centre which were introduced after work had started on site. The main (high value) changes were:

- Catering base build and fit-out (£641,679)
- Revised West Entrance (£24,000)
- Additional power and data provision (£18,000)
- Landscape works (£242,420)
- Changes to UG Centre (£64,831)

Risk management was a key part of the project monitoring process. This was handled well with a risk register being produced at an early stage and monitored by the PMG.

12. Procurement and Cost Management

Procurement

The Project Manager, Quantity Surveyor, Architect, Structural and Building Services Engineers were appointed off the University's existing Consultant Framework.

There was no novation on this project, the Architect and Structural and Building Services Engineers being retained on the client side to carry out a project monitoring role following the appointment of the main contractor part way into Stage E. The University was very keen to appoint a 'signature' Architect for this project. Hopkins were appointed on the basis of having developed the Masterplan and previous experience of working with the University.

This was a challenging project for the Architects as the University was insistent that the original concept design for the external appearance of the building had to be adhered to and this has certainly been achieved.

Original 3D concept image

The Consultant Team performed well on this project. In particular, the Architects completed detailed drawings well beyond that required for Stage D which helped to safeguard the design and ensure the original design concept approved by the University was delivered.

In order to maintain programme and avoid sensitive exam periods, certain works were undertaken under a separate enabling works contract. These were site clearance, reduced level excavation, below ground drainage diversions and other ground and substructure works including piling.

The main contractor appointment followed standard OJEU and University procedures. Fifty expressions of interest were received initially which, following an assessment of completed pre-qualification questionnaires, was reduced to a shortlist of five contractors who were invited to tender for the main contract.

The appointment of the preferred contractor took place following a detailed assessment of tenders, the process and recommendations being set out in a detailed tender report approved by PMG. Design development beyond Stage D was taken on by the contractor through the appointment of his own design team.

The form of contract used was the JCT Design and Build contract 2005 (revised 2009). This form of contract works well particularly as the changes to the contract clauses are kept to a minimum and thus requiring less negotiation. In this form it is considered to provide good value in balancing cost and quality. It also provides a good level of programme certainty, single point of responsibility, transfer of risks to the contractor and control over key elements of the design.

Cost Management

Table 3 shows the development and control of costs during the construction phase leading up to the final account. Cost reports issued between June 2010 and July 2011 track the anticipated final construction cost and enabling works against the agreed contract sum and gross budget.

Table 3 Cost Management

No	Date	Current Budget	Enabling Works Cost	Main Works Cost	Total Cost	Contingencies
1	June 10	9,997,565	512,787	9,051,427	9,564,214	254,335
2	July 10		440,233	9,190,329	9,630,562	232,424
3	Aug 10		440,233	9,246,819	9,687,052	175,934
4	Sep 10		440,233	9,285,343	9,725,576	175,874
5	Oct 10		440,233	9,286,683	9,726,916	174,531
6	Dec 10		440,233	9,020,539	9,460,722	536,803
7	Feb 11		440,233	9,284,493	9,724,726	272,849
8	April 11		440,233	9,611,371	10,051,604	36,000
9	June 11		440,233	9,434,818	9,875,051	122,524
10	July 11	10,147,565	440,233	9,751,465	10,191,698	0

Note: Figures shown are gross costs including fees and VAT

A value engineering exercise took place during the development of the project which helped to ensure costs were refined and that 'buildability' continued to be cost effective.

Costs were managed well on this project. Regular cost plans and cost checks were prepared prior to construction and once this commenced, regular cost reports were produced. The PMG was kept regularly informed through the cost reports and was able to monitor expenditure effectively.

The final account was agreed and issued in May 2012 and reflects the client changes relating to the additional works and VAT increase. When these additional works are taken into account it can be seen that the project was delivered within the University's construction budget:

At Start of Construction	Enabling works	£ 459,326
	Main contract	£6,002,052
	Total	£6,461,378
At Final Account stage	Enabling works	£ 316,418
	Main contract	£6,117,373
		£6,433,791
	Additional works	£ 948,930
	VAT	£1,476,544
	Total	£8,859,265

13. Sustainability

The design brief for this project stipulated a BREEAM target of 'Excellent' which conforms to the requirement of the University's Carbon Management Plan.

It is a requirement of the Nottingham City Council Planning Guidelines that 10% of all energy used (interpreted through CO_2 emissions) in new developments over 1000m² be obtained from low carbon emission or renewable energy sources. The design intent was that following an appraisal of possible options this would be achieved through the provision of a ground source heat pump system which would be used for the heating and cooling of the atrium.

The utilisation of the University's District Heating supply also has the following advantages:

- Reduced plant room area
- No flues or emissions
- No natural gas brought on to site
- No emission noise from boiler
- No visible services for the heat generating plant

Energy Consumption figures have been obtained from the University's Estate Office for the period 18 June 2012 to 16 June 2013. Lack of data prevents comparisons relating to the District Heating as the heat meter measuring the consumption was not working until April 2013. There was also no heat meter fitted for the GSHP.

Only the summary total for electricity including comparative CO_2 emissions are therefore shown below and the emissions figure compared with the EPC rate:

	kWh/annum	$kgCO_2/m^2/annum$
Electricity	353,163	42.18
EPC		15.05

This shows that there is a wide discrepancy between the two figures which to a certain extent can be explained by the EPC figure excluding small power electricity consumption.

Table 4 shows a comparison of the total predicted energy consumption and CO_2 emissions compared to actual electricity consumption and emissions.

Table 4 Energy Predictions Compared to Actual Performance

	PREDICTED		ACTUAL	
	kWh/annum	$kgCO_2/annum$	kWh/annum	$kgCO_2/annum$
GSHP			No heat meter fitted	
District Heating			Data incomplete	
Electricity			353,163	149,034
Total	**211,812**	**89,385**		

Conversion figure used: 0.422 $kgCO_2$ for Grid Electricity

It is accepted that the predicted figures are based on benchmark data for similar buildings and exclude small electrical power but there needs to be more accurate assessment made at the various stages of the project through to post occupancy evaluation stage by the Building Services consultants working in liaison with the University's Energy Manager.

The University commissioned Consultants, Anderson Green, to review the reporting methodologies between the predicted energy consumption and CO_2 emissions for new build capital projects and their report was published in April 2012.

The recommendation of the report was that for each capital project a Building Energy and Environmental Model (BEEM) should be produced with energy data compiled at design and construction stages and at post occupancy.

This will enable information to be produced on which a suitable predicted energy consumption target can be compared with real metered information at post occupancy stage.

Regarding recording of energy consumption currently, it is disappointing that it has taken a considerable amount of time to resolve the problem with the meters and that data has only started to be recorded on the Elcomponent MeterRing system. Closer monitoring is perhaps needed and actions taken as soon as problems are identified.

A number of energy efficiency and sustainability initiatives have been incorporated into the building, namely:

- Ground Source Heat Pump
- District Heating supply
- Passive design
- Underfloor heating to atrium
- Sensor controlled lighting
- Rainwater harvesting
- Concrete aggregate: recycled rail ballast

Recommendations

i) Ensure the use of the Anderson Green Report to enable a suitable predicted energy consumption target to be compiled which can be compared to real metered information at post occupancy stage

ii) Ensure proper commissioning including monitoring of the metering system so that actions can be taken in rectifying any data recording problems at an earlier stage

iii) Fit heat meter to GSHP

14. Summary of Recommendations

	Actions
User Issues	
i) Where late client changes are made, PMG, having been provided with sufficient information, should be made fully aware of the implications of their decision	Capital Projects
ii) In the Engineering Support Centre office consider installing a screen to reduce noise disturbance emanating from the student reception counter area	Users
iii) Investigate the cause of the shut down of the automatic windows in the Engineering Support Centre office and reinstate the automatic controls in order to improve air quality and temperature	Closed out
iv) Complete the modifications to seminar room C01	Development
v) Consider subdividing one of the seminar rooms with low utilisation rates in order to improve use	SMC
vi) *Consider the specification of the 'white boards' on future projects appropriate for location and type of use*	SMC/Teaching & Learning
Construction Issues	
ii) Ensure sufficient time is allowed where possible for the commissioning period	Capital Projects
Facilities and Operations	
i) Continue to improve the communication with the Maintenance Team	Capital Projects Operations & Facilities
ii) Reinforce the procedure for fault reporting by users through the Helpdesk and encourage building users to adopt this approach	Operations & Facilities
iii) Ensure FM Cleaning are consulted when finishes are selected/ changed so that appropriate storage for cleaning equipment is allowed for	Operations & Facilities
Sustainability	
i) Ensure the use of the Anderson Green Report to enable a suitable predicted energy consumption target to be compiled which can be compared to real metered information at post occupancy stage	Sustainability Team
ii) Ensure proper commissioning including monitoring of the metering system so that actions can be taken in rectifying any data recording problems at an earlier stage	Sustainability Team
iii) Fit heat meter to GSHP	Sustainability Team

APPENDIX 1

Sample Questionnaire

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

QTC projects

POST OCCUPANCY EVALUATION

BUILDING USER SATISFACTION QUESTIONNAIRE (On-line survey method used)

BUILDING: ENGINEERING & SCIENCE LEARNING CENTRE

Occupation (Please tick most relevant or state in 'other')
Academic staff
Admin staff
Research staff
PGR student

An evaluation of your building is being conducted to assess how well it performs for those who occupy it. This information will be used to assess areas that might need improvement and provide feedback that can be used for the benefit of similar future buildings.

Please complete the following questions relating to the above project by ticking the appropriate boxes and adding comments where requested.

1 – Satisfaction with types of space in building

Please rate the overall quality of the following areas:
(Please tick)

A: Graduate Centre Working Space	1 V Poor	2	3	4	5 Excellent
B: Graduate Centre Social Space	1 V Poor	2	3	4	5 Excellent
C: Graduate Centre seminar space	1 V Poor	2	3	4	5 Excellent
D: Seminar Rooms					
E: Computer Suite	1 V Poor	2	3	4	5 Excellent
F: Shared Office	1 V Poor	2	3	4	5 Excellent
G: Reception Desk Area	1 V Poor	2	3	4	5 Excellent
H: Office Storage	1 V Poor	2	3	4	5 Excellent
I: Toilets	1 V Poor	2	3	4	5 Excellent
J: Kitchen	1 V Poor	2	3	4	5 Excellent
K: Storage	1 V Poor	2	3	4	5 Excellent
L: Overall Impression	1 V Poor	2	3	4	5 Excellent

2 - Security

2.1 How safe do you feel in the building? (*Please tick)*

Unsafe Very safe

1	2	3	4	5	6	7	8	9	10

3 - Accessibility

3.1 How accessible is the building?

Not Accessible — Very accessible

1	2	3	4	5	6	7	8	9	10

4 - Cleanliness

4.1 How clean is the building?

Dirty — Clean

1	2	3	4	5	6	7	8	9	10

5 - Temperature

5.1 Is the temperature in winter too cold or too hot?

Too cold — Too hot

1	2	3	4	5	6	7	8	9	10

5.2 Is the temperature in summer too cold or too hot?

Too cold — Too hot

1	2	3	4	5	6	7	8	9	10

6 - Noise

6.1 Do you suffer distraction caused by noise in your part of the building?

Very significant — Not significant

1	2	3	4	5	6	7	8	9	10

7 - Light

7.1 Is there too much or too little natural light?

Too little — Too much

1	2	3	4	5	6	7	8	9	10

7.2 Is the level of artificial light too high or too low?

Too low — Too high

1	2	3	4	5	6	7	8	9	10

8 - ICT/Data

8.1 How well is voice and data connectivity provided at the workspace?

Inadequate Well provided

1	2	3	4	5	6	7	8	9	10

8.2 Is the AV equipment in the teaching/lecture rooms effective?

Does not work well Works well

1	2	3	4	5	6	7	8	9	10

10 - Comments

If you have any additional comments that you would like to make about any aspect of the building and your working environment please note them here. If relevant to a particular question please give the question number.

Thank you for completing the questionnaire.
Completed forms should be returned to Tony@qtcprojects.co.uk

Appendix 2

ENGINEERING & SCIENCE LEARNING CENTRE

Post Occupancy Evaluation Workshop

Held on Wednesday 10 July 2013

List of Attendees

User Representatives

Delia Stirland	Student Support Manager

Apologies

Tessa Payne	Graduate Centre Manager
Charlie Hallam	Faculty Infrastructure Manager
Prof Wyn Morgan	Assistant PVC, Director of Teaching & Learning

Estate Office

Mark Bonsall	Senior Engineer
Tim Brooksbank	Development Director
Richard Wigginton	Senior Capital Project Officer
Lisa Haynes	Space Resource Manager
Chris Dickinson	General Manager Maintenance
Cliff Hogan George	Domestic Services Operations Manager

Apologies

Steve Gilbert	Senior Building Surveyor

Design Team

Steve Jones	Hopkins Architects
Miles Delap	GTMS - Project Manager
Alastair Wolstenholme	Gardiner Theobald- Quantity Surveyor
Steve Fernandez	Arup – Structural/Building Services Engineers

Contractor

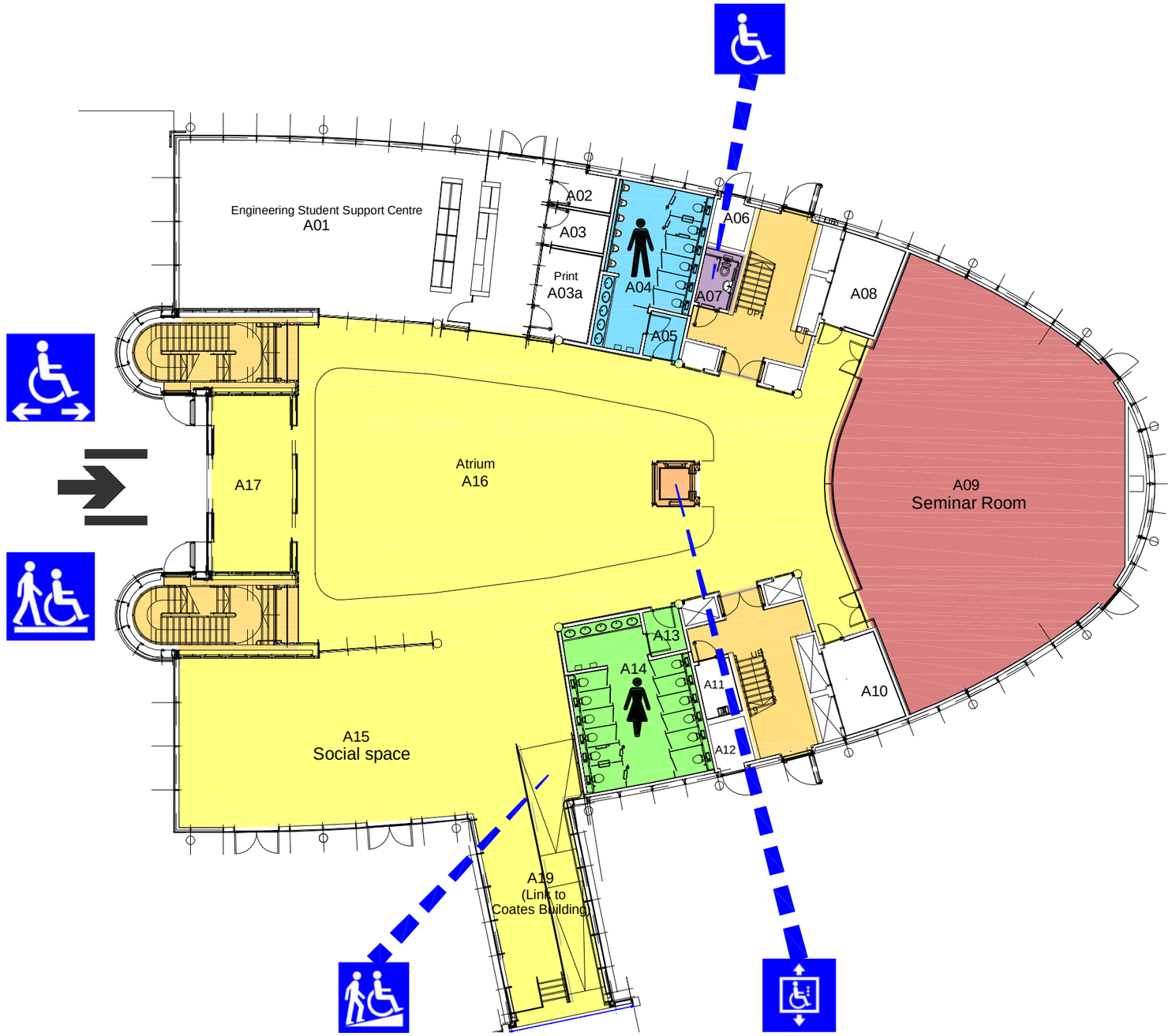
Rob Sullivan	Mansell Construction

APPENDIX 3

Floor Plans

Engineering & Science Learning Centre (ESLC) - A Floor Plan

The University of Nottingham



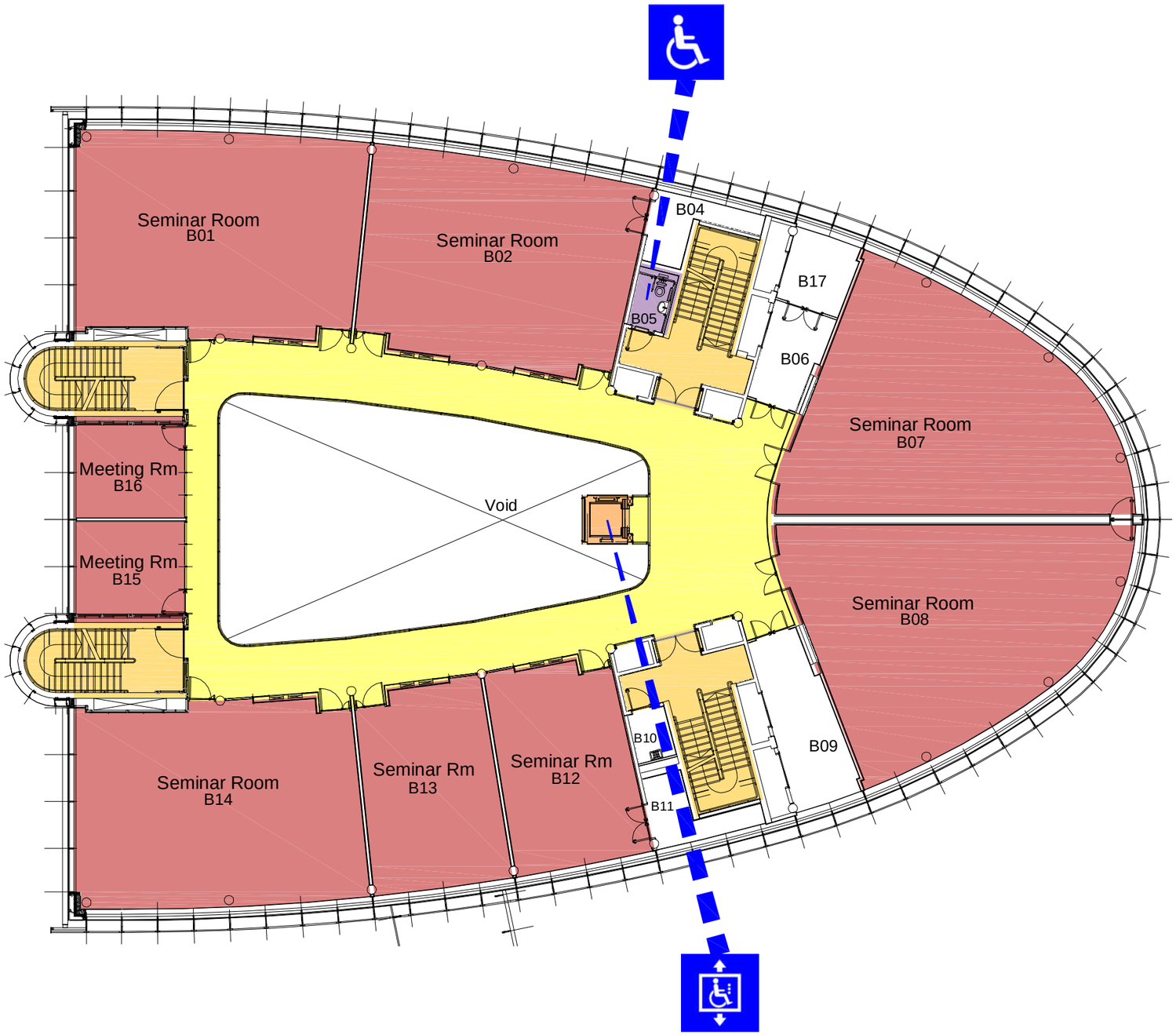
Key

- Designated Badge-Holder Parking
- Access Ramp
- Automatic Doors
- Accessible Lift
- Entrance
- Accessible Entrance
- Evacuation Chair
- Emergency Refuge
- Toilet (Female / Male)
- Accessible Toilet
- Shower
- Accessible Shower
- Stairs
- Lift
- Central Timetabled Room
- Circulation
- Reception
- Refectory/Cafe
- Fire Assembly Point

August 2011
Estate Office
www.nottingham.ac.uk/estate/

Engineering & Science Learning Centre (ESLC) - B Floor Plan

The University of Nottingham



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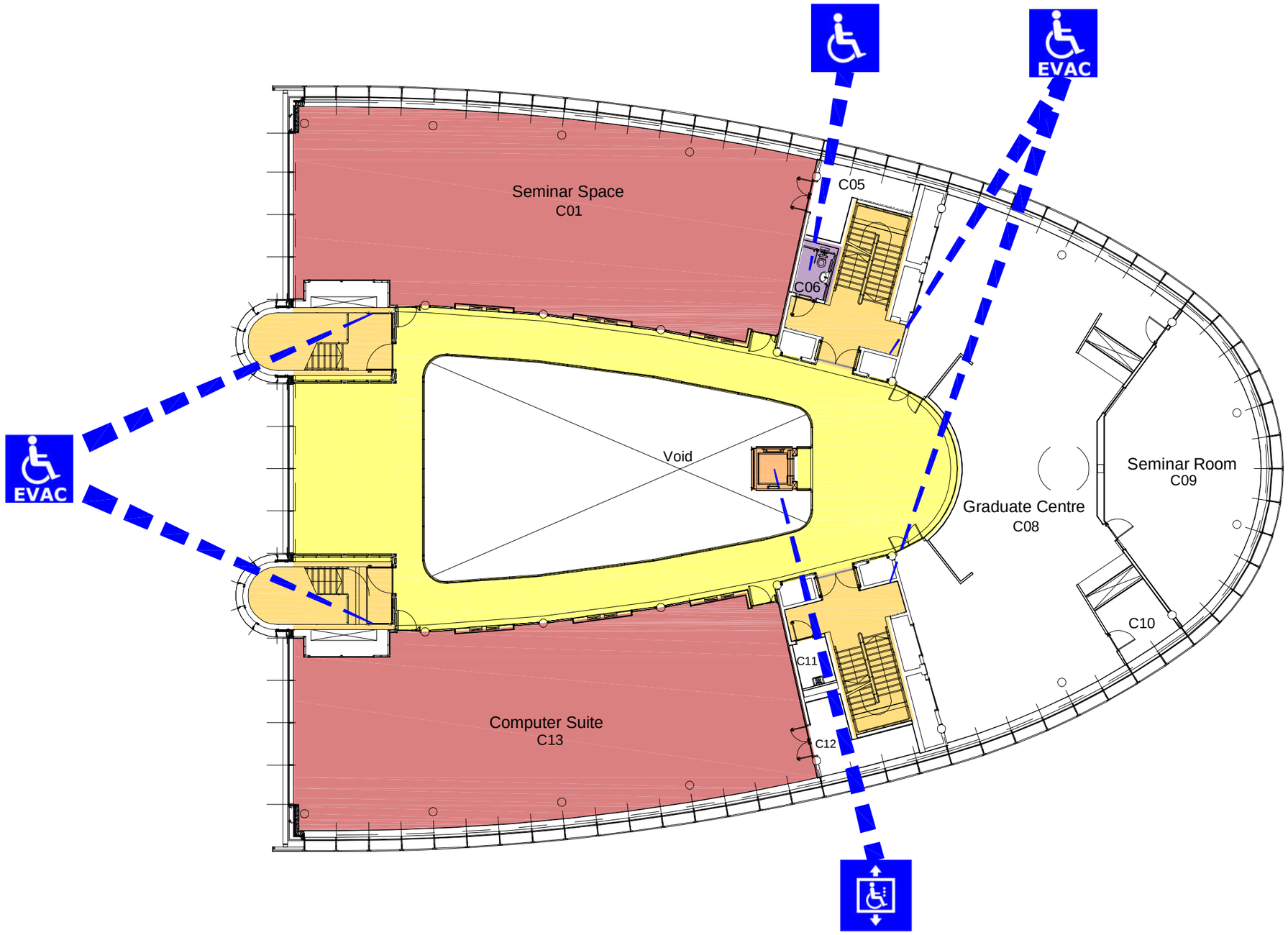
- Accessible Shower
- Stairs
- Lift
- Central Timetabled Room
- Circulation
- Reception
- Refectory/Cafe
- Fire Assembly Point

August 2011
Estate Office
www.nottingham.ac.uk/estate/

Engineering & Science Learning Centre (ESLC) - C Floor Plan

The University of Nottingham



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